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DOCKET CONTROL

December 4, 2014

Steven M. Olea
Director, Utilities Division
Arizona Corporation Commission – Phoenix Office
1200 W. Washington St.
Phoenix, AZ 85007

RE: Sandstone Solar LLC – Facilities Ten Year Plan

E-00000M-08-0170

Dear Mr. Olea,

Pursuant to ARS § 40-360.02, Sandstone Solar LLC would like to submit this ten year plan for the Sandstone Solar project corresponding to the years of 2014-2023. The Sandstone Solar project will be built in Florence and requires a two-span transmission line which will interconnect this solar project with one of Salt River Project's 115 kV lines. Sandstone Solar LLC intends to file an application for a Certificate of Environmental Compliance for the transmission line as required pursuant to Laws 1971, Ch. 67, § 1 and the Siting Committee's jurisdiction over 115 kV above-ground transmission lines.

Sandstone Solar LLC is a wholly-owned subsidiary of FTP Solar (dba sPower). Sandstone Solar LLC is a limited liability corporation established with the explicit purpose of developing, constructing, and operating the Sandstone Solar project and its interconnection facilities.

Please do not hesitate to contact me should you have any questions about this ten year plan filing.

Sincerely,

Daniel Wang

Daniel Wang
Sustainable Power Group
2 Embarcadero Center, Suite 410
San Francisco, CA 94111
dwang@spower.com
Office: 415.872.0764
Mobile: 858.472.8533

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Sandstone Solar LLC

Ten Year Plan

Electric Transmission Line

1. The size and proposed route of any transmission lines or location of each plant proposed to be constructed.
The transmission line is located at the intersection of East Hunt Highway and North Felix Road, Florence, AZ 85132. The line route runs north to south parallel to North Felix Road, which has an expected length of 0.15 miles (two spans). Please reference Exhibit A for the transmission line site diagram. The plant location is located on Valley Farms Road to the southeast of the transmission line.

2. The purpose to be served by each proposed transmission line or plant.
This transmission line will connect the project site to Salt River Project's 115kV line to the north side of East Hunt Highway. The proposed PV plant, which is not subject to the Certificate of Environmental Compliance requirement, is planned to export power up to 45 Megawatts AC to SRP.

3. The estimated date by which each transmission line or plant will be in operation.
The transmission line is expected to be in operation on December 15, 2015.

4. The average and maximum power output measured in megawatts of each plant to be installed.
The Solar PV project is expected to have a maximum power output of 45 Megawatts AC (58 Megawatts DC). The average power output for the first year of operation is expected to be 14.7 Megawatts AC.

5. Expected capacity factor of the PV plant.
The capacity factor of the PV plant is 33%.

6. The type of fuel to be used for each proposed plant.
Solar Photovoltaic

7. Power flow and stability analysis report showing the effect on the current Arizona electric transmission system
Please reference the report from the attached System Impact Study conducted by SRP Substation Design, section 2.3.

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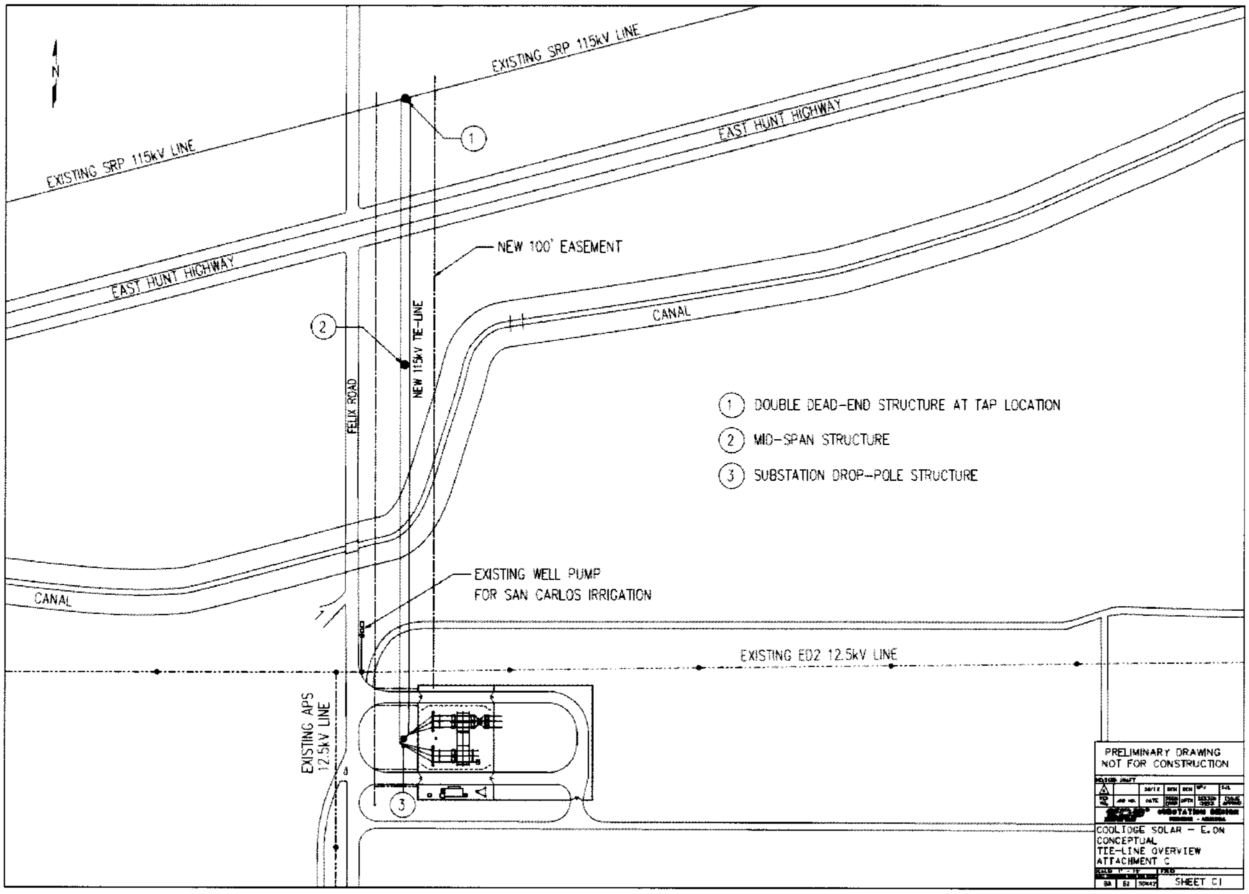
Exhibit A



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Q24 Solar
Generation Interconnection

System Impact Study

Final Report

by

Salt River Project
Transmission Planning

March 20, 2012

TABLE OF CONTENTS

LIST OF APPENDICES

1. EXECUTIVE SUMMARY

This Report on System Impact Study- Q24 Solar Generation Interconnection ("Report") summarizes the System Impact Study (SIS) results for solar interconnector identified by SRP queue numbers as Q24. Specific details of these proposed interconnection's impacts on the surrounding transmission system are in the "Results" section of this Report.

Introduction:

Under provisions of the Salt River Project Agricultural Improvement and Power District (SRP) Open Access Transmission Tariff (OATT), SRP and Interconnection Request Q24 ("Applicant") have entered into a System Impact Study Agreement. Q24 plans to install 45MW of photovoltaic solar generation by 5/2013. Q24 is interconnecting into the SRP transmission line from Coolidge to Bonneybrook, within the SRP 115kV system in the Eastern Mining Area (EMA). **Figure I** (following page) shows a diagram of the project interconnecting Coolidge-Bonneybrook 115kV line.

Study methodology:

The SIS examined the impact of Q24 on the surrounding transmission system. The specifications for the project included in the SIS modeling were those provided by the Applicant, as required by the SRP OATT Large Generator Interconnection Application and subsequent correspondence.

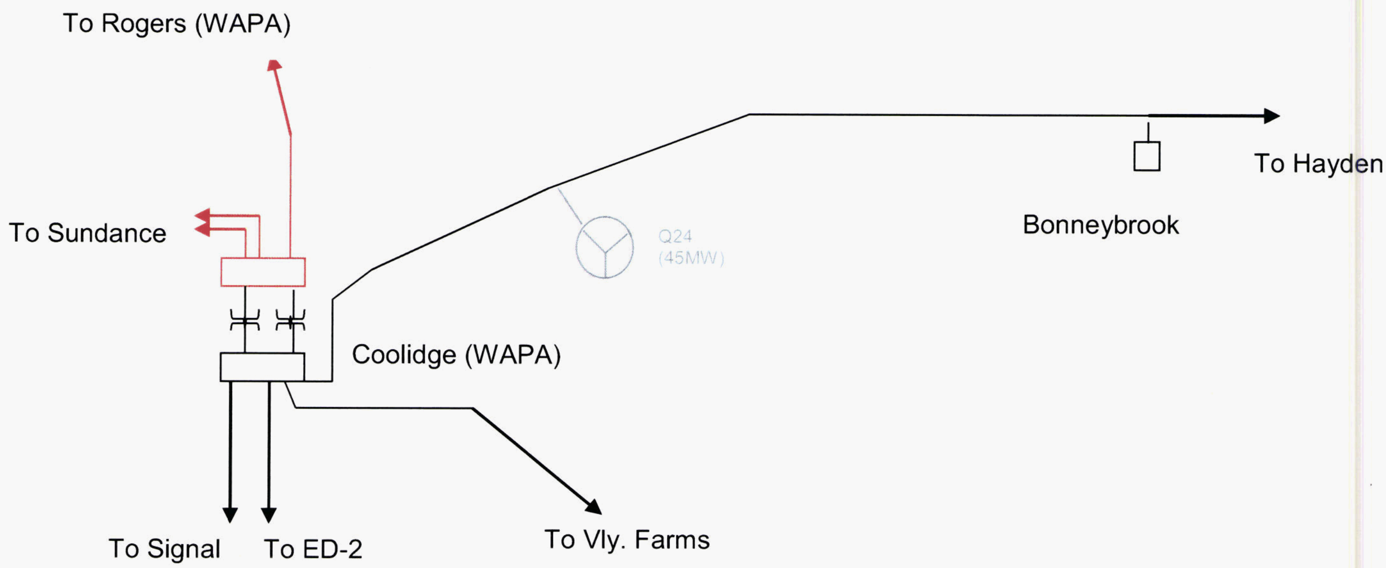
Analyses for the proposed generator installation consisted of computer-based (steady-state) power flow, post-transient, transient stability and short circuit/fault duty analysis.

Selected contingencies (known to stress the local transmission system) were applied to the study cases. Results from the thermal and voltage analyses were monitored for Arizona (Area 14).

System performance criteria:

The SIS system performance criteria were consistent with both NERC/WECC's Reliability Criteria and Planning Standards and SRP local reliability criteria. For more detailed information on the criteria used for each analysis see the "Reliability Analysis" section of this Report.

Figure I. SRP Coolidge-Bonneybrook 115kV Line and Q24 Interconnection



Results:

The SIS assumed transmission network topology based on SRP's most current transmission plans for the area.

The impact of the Q24 were analyzed for the in service year of the project, 2013. The study was initially conducted as Network Interconnection. The proposed interconnection do not require new or expedition of previously planned SRP transmission facilities. No new violations of the WECC system performance criteria were found in the Study's post-project base cases or in the Study's post-project contingency cases.

Due to no impact from the Network Interconnection part of the study, the Energy Interconnection part of the study was unnecessary.

Good Faith Estimate of costs:

There are no network mitigation costs identified with interconnection of the Q24 solar interconnector.

The SIS provides non-binding good faith estimate of cost responsibility, which in this case represents only interconnection facilities. The total cost is estimated at $5.5M.

2. STUDY ASSUMPTIONS

This section provides an overview of major study assumptions and details pertaining to the development of the cases and short circuit database(s) used in this SIS. The results identified in this SIS Report are extremely dependent upon the assumed topology. The overall transmission system is continuously being evaluated; planned reinforcements and their in-service dates are often revised depending upon local area load growth and/or other changes.

The SIS was performed in order to assess the technical impacts of the interconnections on all affected transmission systems. If upgrades were necessary, a plan of service was developed to facilitate a reliable interconnection with the transmission system. The Study was comprised of the following technical analyses:

- Power flow analysis
- Post transient stability analysis
- Transient stability analysis
- Short Circuit analysis

The planned in service date for Q24 interconnector is 5/2013. Thus, the analysis was conducted on 2013 SRP (detailed) peak planning case. The case was created from APS/SRP Coordinated Base Cases and based in the WECC 14hs3sacase (heavy summer case).

The SRP EMA loads are predominantly mining industrial loads. Although load variations throughout year in the SRP EMA are not extreme, adjacent non- SRP system loads are more variable. Therefore, in addition to heavy summer, SRP performed the study on an off-peak case.

The off peak case was built from 12lw2a case. The case was built as low winter case in order to explore the impact during the low load conditions, with the high Q24 generation output. No local conventional generation was modeled in service. The system additions from 2012 to 2013 were modeled in the case in order to create a true 2013 off peak case.

The generation at Apache and Sundance generating stations creates most significant impacts in the area near the interconnection for Q24. Therefore, the cases with combinations of these units on line and off line were explored, too. The base model in the peak case has Apache generation on and Sundance generation off line.

The post project cases were built with Q24 generation modeled in service. This generation replaced 45MW of generation at SRP Kyrene 4 (peak cases) and Santan Unit 5 (off-peak cases).

The studied cases are listed in the **Table I**, below:

Table I. Base case Modeling Summary

	#	Base Cases/Scenario Description	Case additions		
			Apache Generation	Sundance Generation	Q24 Interconnection Impact
	1.	2013 Pre-Project			
	2.	2013 Pre-Project Apache On	√		
	3.	2013 Pre-Project Sundance On		√	
	4.	2013 Pre-Project Apache & Sundance On	√	√	
	5.	2013 Post-Project			√
	6.	2013 Post-Project Apache On	√		√
	7.	2013 Post-Project Sundance On		√	√
	8.	2013 Post-Project Apache & Sundance On	√	√	√
Off Peak Cases	9.	2013 Pre-Project			
	10.	2013 Pre-Project Apache On	√		
	11.	2013 Pre-Project Sundance On		√	
	12.	2013 Pre-Project Apache & Sundance On	√	√	
	13.	2013 Post-Project			√
	14.	2013 Post-Project Apache On	√		√
	15.	2013 Post-Project Sundance On		√	√
	16.	2013 Post-Project Apache & Sundance On	√	√	√

2.1 SRP Q24 Project Modeling

Q24 interconnector was modeled as generator connecting at the low side of the transformer. The high side of the transformers tied to SRP system by 115kV line. The length of the lines and conductors used were provided by interconnector. The following data for Q24 has been provided:

Generator Net Output: 45 MW
Transformer: 115/34.5kV – 8% impedance on 44MVA base
Transmission Tie Line: ~ adjacent to Coolidge-Bonneybrook 115kV line;

The required reactive support was modeled as +/-0.95 power factor at the Point of Interconnection (POI).

2.2 Short Circuit Modeling

The model for the Q24 interconnector was developed per the Applicant's information. The interconnector was modeled as equivalent unit connecting to 34.5kV buses. A single 34.5/115kV step-up transformer was used to interconnect to 115kV SRP system.

The Short Circuit (SC) contribution from Photovoltaic Solar Generators is well explored and documented topic. The commonly known value from a PV interconnector equals 1.1x nominal current.

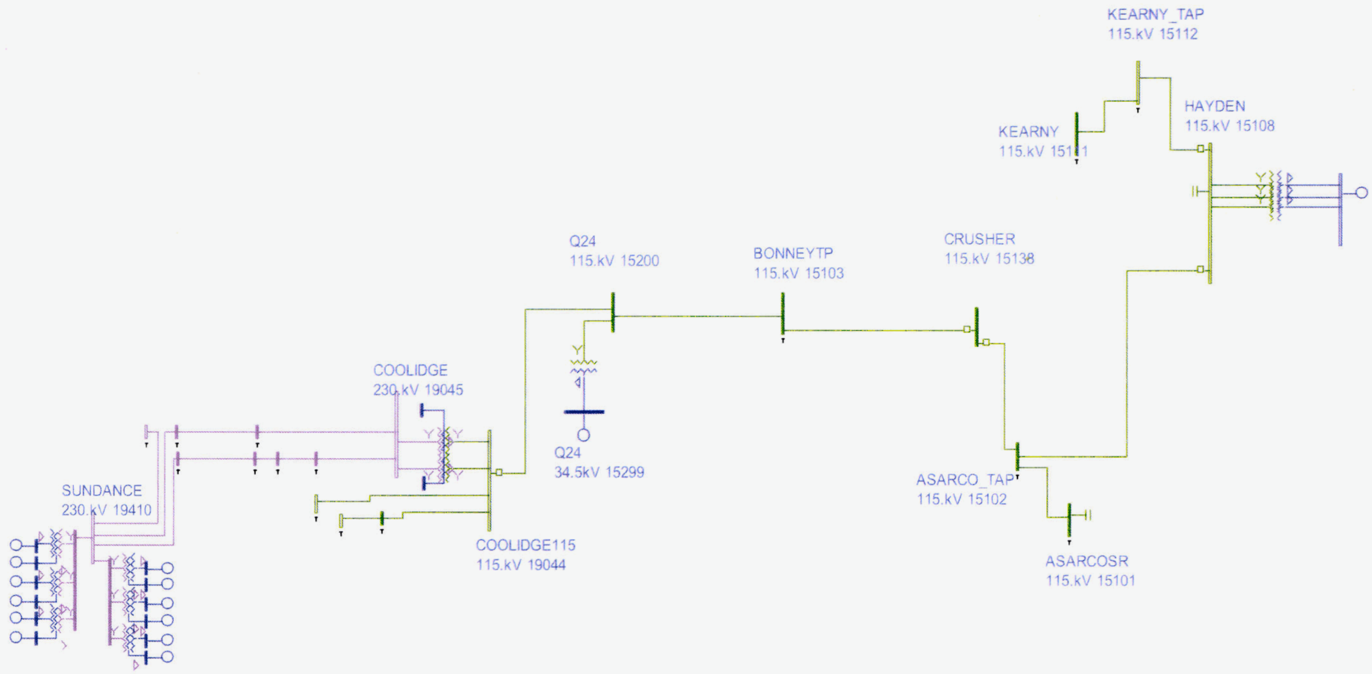
In order to determine the validity of this assumption, a transient stability study with a fault at Coolidge 115kV bus was conducted. This study confirmed the industry recommended value for short circuit contribution of PV plants. The study plot can be found in the Appendix D.

To model this contribution, the subtransient reactance for Q24 interconnector was adjusted in order to achieve this SC current value at the POI. The details of the short circuit model are listed below.

<u>Q24 (45 MW net output):</u>
Transformer: 115/34.5kV – 8.0% on 44MVA base; Wye-grounded-Delta
Max SC: 248A @ 115kV

The above interconnector models were added to the SRP pre-project base. **Figure II** illustrates the model that was developed in the ASPEN One-Liner post-project case.

Figure II: SRP Coolidge – BonneyBrook 115kV line and adjacent buses in 2013



2.3 Reliability Analysis

This section provides a brief summary of the applied reliability criteria used in this study.

2.3.1 Power Flow Analysis

Power flow analysis was performed using the General Electric's Positive Sequence Load Flow (GE PSLF) program, version 17.6.

Study Criteria:

a) Normal Conditions
   i. All transmission facility loadings must be below normal continuous ratings.
   ii. Bus voltage deviation from the base case shall not exceed established operating limits.

b) Single Contingency Outage Conditions
   i. For a single contingency, no transmission element will be loaded above its emergency rating.
   ii. Equipment emergency voltage limits (high or low) will not be exceeded for single contingency outages.
   iii. Bus voltage deviations from the base case voltage shall not exceed established planning limits (these limits may vary throughout the system).
   iv. Single contingency outages on the BES system will not result in loss of load.

c) Multiple Contingency Outage Conditions
   i. For a double contingency, no transmission element will be loaded above its emergency rating.
   ii. Established loading limits for other utilities will be observed.
   iii. Equipment emergency voltage limits (high or low) will not be exceeded for double contingency outages.
   iv. Bus voltage deviations from the base case voltage shall not exceed established planning limits (these limits may vary throughout the system).

2.3.2 Post-Transient Analysis

To examine the post-transient thermal and voltage impacts of the Project, a post-transient/governor-based power flow analysis was performed to determine if the voltage deviations at critical buses meet the maximum allowable voltage dip criteria for selected N-1 and N-2 disturbances. All areas and voltage levels were monitored and only those locations where an effect is observed were considered.

Study Criteria:
The following criteria was used to evaluate the post-transient voltage stability performance:

a) Transient voltage dips should meet the following WECC Reliability Criteria (WECC Table W-1 and NERC Table I):

Performance Level	Disturbance	Post-Transient Voltage Deviations
B	N-1	< 5%
C	N-2	< 10%
D	N-3	Cascading Not Permitted

b) The reactive margin at each bus should meet the following WECC Reliability Criteria:

Performance Level	Disturbance	Post-Transient Reactive Margin
B	N-1	> 0 with load in the area at 105.0% of base case
C	N-2	> 0 with load in the area at102.5% of base case
D	N-3	> 0 with load in the area at 100.0% of base case

c) The generator base load flag, which is set in the GENS table of WECC PSLF cases, was used in the redistribution of active power among on-line generators in accordance with WECC guidelines on post-transient governor power flow methodology.

d) The automatic control of switched shunt devices - such as those Static Var Devices (SVDs) in SRP's 115kV EMA system – were not disabled when running these simulations, unless failure of the SVD is part of the contingency event being simulated.

2.3.3 Transient Stability Analysis

Transient stability analysis is conducted using both the pre and post-project cases and corresponding dynamic data file. All areas and voltage levels are monitored and only those locations where an effect is observed were considered.

Study Criteria:
a) Transient voltage dips must meet the following WECC Reliability Criteria (WECC Table W-1 and NERC Table I):

Performance Level	Disturbance	Transient Voltage Dip Criteria
B	N-1	Transient Voltage Dip: Not to exceed 25% at load buses or 30% at non-load buses. Also, not to exceed 20% for more than 20 cycles at load buses. Minimum Transient Frequency: Not below 59.6 Hz for 6 cycles or more at a load bus.
C	N-2	Transient Voltage Dip: Not to exceed 30% at any bus. Also, not to exceed 20% for more than 40 cycles at load buses. Minimum Transient Frequency: Not below 59.0 Hz for 6 cycles or more at a load bus.
D	N-3	Not Specified

b) All machines in the system shall remain in synchronism as demonstrated by their relative rotor angles.

c) System stability is evaluated based on the damping of the relative rotor angles and the damping of the voltage magnitude swings.

2.3.4 Short Circuit Analysis

Short Circuit Analysis of the proposed Q24 interconnection was performed by using the parameters supplied by the Applicant. Fault duty was calculated for both single-phase-to-ground and three-phase faults at substation busses in the immediate surrounding area, before and after the proposed generator interconnection.

Study Criteria:

a) Circuit breakers exposed to fault currents in excess of 100 percent of their interrupting capacities will be replaced or upgraded, whichever is appropriate.

Study Assumptions:

b) System data was based on the pre-project system configuration. In addition, future generation projects were modeled to provide a “worst case” scenario. Short circuit analysis was performed with SWAT short circuit database.

c) All impedances were expressed in per unit on a 100 MVA base. The base voltage for each impedance element was the nominal voltage for that part of the system in which the impedance occurs.

d) Each system element was represented as complex impedance in the three-symmetrical component network (positive, negative, and zero sequences).
e) The Aspen One-Liner short circuit program was used to compute three-phase, and single phase-to-ground faults.
f) The maximum fault current for each breaker was determined by placing a fault on the bus and recording the maximum fault current.

3. RESULTS

3.1 Thermal Loading Results

The pre-project cases established the benchmark conditions prior to the additions of Q24 Solar interconnector. The power flow studies were conducted on the cases defined in Table I.
The power flow studies were conducted for both, peak and off-peak cases. These cases were based at different seed cases. Thus, each case has a separate contingency list containing elements of bulk electric system (BES), or elements operated at voltage levels 100kV and above.

In addition to this, the contingency lists contain number of multiple contingencies from the SRP's EMA area. The contingency lists can be found in the Appendix A.

<u>*Peak 2013 Case Thermal Results*</u>
The studies for 2013 peak period were conducted on peak cases from Table I. Pre Q24 cases showed couple of overloads in the area of southeastern Arizona, primarily for cases without Apache generation on line. This scenario is highly unlikely, because Apache generation operates most of the day for summer peak conditions.

Post project cases with Q24 interconnector in service confirmed negligible impact of Q24 on surrounding system. The interconnector does not impacts any system element more than 5%. The biggest negative impact of 1.2% was found on Tucson – Oracle 115kV line. The results can be found in Table II below.

<u>*Off-Peak 2013 Case Thermal Results*</u>
The studies for 2013 off peak period were conducted on off peak cases from Table I. Again, pre Q24 cases pointed to couple of overloads in the area of southeastern Arizona, primarily for cases without Apache generation on line.

Due to the study being conducted for the low load scenario, it is possible for Apache generation to be out of service. However, addition of Q24 does not impact these overloads negatively – it decreases the loading on the impacted elements. System wide, the interconnector does not impacts any element more than 5%. The results can be found in Table II below.

Table II. 2013 Thermal Overload Results

Peak 2013	Rating	Pre Project	Post Project	Pre Project w/ Sundance	Post Project w/ Sundance	Pre Project w/ Apache	Post Project w/ Apache	Pre Project w/ Apache & Sundance	Post Project w/ Apache & Sundance
N-1 Prescott-BagdTwn 115kV Line									
BagdTwn – BagCap 115kv Line	700A	146.0%	146.0%	146.0%	145.9%	146.0%	146.0%	146.0%	145.9%
N-1 CopperRvr 345/230kV #1 Transformer									
CopperRvr 345/230kV #2 xfmr	224MVA	100.9%	100.9%	100.3%	100.3%	78.5%	78.4%	77.9%	77.8%
N-1 CopperRvr 345/230kV #2 Transformer									
CopperRvr 345/230kV #1 xfmr	224MVA	100.9%	100.9%	100.3%	100.3%	78.5%	78.4%	77.9%	77.8%
N-1 CopperRvr-Frisco 230kV Line									
Green-SW 345/230kV #1 xfmr	241MVA	157.0%	156.9%	156.0%	155.8%	117.6%	117.4%	116.6%	116.4%
N-1 PD-Morenci-Frisco 230kV Line									
Green-SW 345/230kV #1 xfmr	241MVA	135.5%	135.4%	134.5%	134.4%	96.8%	96.6%	95.7%	95.6%
N-1 Greenlee-CopperRvr 345kV Line									
Green-SW 345/230kV #1 xfmr	241MVA	156.8%	156.6%	155.7%	155.6%	117.4%	117.2%	116.4%	116.2%
Off Peak 2013	Rating	Pre Project	Post Project	Pre Project w/ Sundance	Post Project w/ Sundance	Pre Project w/ Apache	Post Project w/ Apache	Pre Project w/ Apache & Sundance	Post Project w/ Apache & Sundance
N-1 CopperRvr-Frisco 230kV Line									
Green-SW 345/230kV #1 xfmr	241MVA	106.6%	106.4%	105.6%	105.4%	66.5%	66.3%	65.6%	65.4%
N-1 Greenlee-CopperRvr 345kV Line									
Green-SW 345/230kV #1 xfmr	241MVA	106.3%	106.1%	105.3%	105.1%	66.1%	65.9%	65.2%	65.0%

3.2 *Voltage Results*

To identify potential voltage impact of the Q24 Solar interconnector, the 2013 peak and off-peak cases were monitored for steady-state normal and post-contingency voltage performance. The studies were conducted on all cases from Table I.

Pre Q24 2013 cases showed voltage deviations higher than 5% in the area of concern (central and southeastern Arizona). However, the results indicate that the interconnection impact will be negligible. The results for five highest voltage deviations, in the area of concern, are listed in Table III below. The complete results of the study can be found in the Appendix A.

There were no voltage deviations higher than 5% recorded for 2013 off peak cases. The complete results of the study can be found in the Appendix A.

Table III. 2013 Voltage deviation higher than 5% at the buses in central and southeast AZ

Peak 2013	Pre Project	Post Project	Pre Project w/ Sundance	Post Project w/ Sundance	Pre Project w/ Apache	Post Project w/ Apache	Pre Project w/ Apache & Sundance	Post Project w/ Apache & Sundance	Outage
Sndario 115kV	13.05%	13.05%	12.66%	12.66%	8.86%	8.77%	8.76%	8.67%	Sag.East-Marana Tap - Marana - Rattlesnake 115kV
Avra 115kV	13.11%	13.03%	12.72%	12.54%	8.63%	8.54%	8.52%	8.44%	Sag.East-Marana Tap - Marana - Rattlesnake 115kV
Marana 115kV	12.78%	12.70%	12.39%	12.30%	8.25%	8.16%	8.15%	8.06%	Sag.East-Marana Tap - Marana - Rattlesnake 115kV
Hackberry 230kV	7.54%	7.67%	8.01%	8.05%	4.62%	4.74%	4.77%	4.78%	Hackberry-Morenci 230kV
CopperRVR 345kV	5.15%	5.14%	5.05%	5.04%	2.93%	2.92%	2.83%	2.82%	Springerville-Vail2 345kV

3.3 *Post-Transient Analysis*

<u>*Voltage Results*</u>

To identify the potential voltage impact of the Q24 project, the 2013 peak and off-peak cases with Apache on were monitored for steady-state normal and post-contingency voltage performance. These cases were chosen as the best modeling of system for the summer peak condition. **Table IV** tabulates notable voltage findings for the interconnection where voltage deviation increased between the pre-project and post-project cases.

It can be seen that various busses had pre existing voltage deviation higher than 5%. It is noticeable that Q24 project does not create any negative impact on voltage deviation. There is minor positive impact due to the addition of the project as it can be seen for outages of Avra-Marana and N-2 of Coronado-Silver King & Cholla –Saguaro 500kV lines.

Table IV. Post-transient Voltage Results

Contingency/Bus	Criteria	13peak_apache_on		13offpeak_apache_off	
		Pre-Project	Post - Project	Pre-Project	Post-Project
N-1 Asarco-Crusher 115kV Line					
	< 5%	All < 5%	All < 5%	All < 5%	All < 5%
N-1 Coolidge-Q24 115kV Line					
	< 5%	All < 5%	All < 5%	All < 5%	All < 5%
N-1 HaydenAZ-Knoll 115kV Line					
	< 5%	All < 5%	All < 5%	All < 5%	All < 5%
N-1 Apache-Butterfield 230kV Line					
Hereford 69kV (worst-case)	< 5%	7.3%	7.3%	All < 5%	All < 5%
San Rafael 230kV (worst-case)	< 5%	6.9%	6.9%	All < 5%	All < 5%
N-1 Apache-Red Tail 230kV Line					
San Simon 69kV (worst-case)	< 5%	8.0%	8.0%	All < 5%	All < 5%
Red Tail 230kV (worst-case)	< 5%	6.0%	6.0%	All < 5%	All < 5%
N-1 Avra-Marana 115kV Line					
Sandario 115kV (worst-case)	< 5%	5.3%	5.2%	All < 5%	All < 5%
N-2 Coronado-Silver King & Cholla-Saguaro 500kV Lines					
Greenlee Busses: Valencia 138kV (worst-case)	< 10%	7.1%	7.0%	All < 5%	All < 5%
Vail Busses: Vail2 345kV (worst-case)	< 10%	8.4%	8.3%	All < 5%	All < 5%

Reactive Margin Results

Reactive margin analysis was performed at the busses with worst voltage deviation from Table IV. The margin was found using the cases with increased load in the area of interest by **105%**. The area of interest was defined as southeast Arizona, specifically zones 160-180, 191 (southeast Arizona buses only), 845, 849 and 890 for a heavy summer case. The area of interest for the low winter case was bound by zones 141 (southeast Arizona buses only), 159, 160-165, 171, and 191 (southeast Arizona buses only).

All cases have converged and had positive reactive margin. Q24 project positively impacted margin for majority of the outages near the point of the interconnection. For the outages further away no negative impacts were observed. **Table V** details the results of the reactive margin analysis. Hereford and San Simon 69kV buses were not modeled in the bulk case used for off peak studies.

Table V. Reactive Margin Results (Minimum Per Scenario is Highlighted)

Contingency/Bus	*13peak_apache_on_load105%*		*13offpeak_apache_off_load105%*	
	Pre-Project	*Post - Project*	*Pre-Project*	*Post-Project*
N-1 Asarco-Crusher 115kV Line				
Bonney Brook 115kV	*141MVar*	*150MVAr*	*136MVAr*	*144MVAr*
Coolidge 115kV	*413MVAr*	*429MVAr*	*393MVAr*	*408MVAr*
Hayden AZ 115kV	*144MVAr*	*144MVAr*	*90MVAr*	*90MVAr*
N-1 Coolidge-Q24 115kV Line (Coolidge-Bonney Brook)				
Bonney Brook 115kV	*57MVAr*	*74MVAr*	*43MVAr*	*60MVAr*
Coolidge 115kV	*414MVAr*	*414MVAr*	*393MVAr*	*393MVAr*
Hayden AZ 115kV	*142MVAr*	*161MVAr*	*89MVAr*	*106MVAr*
N-1 HaydenAZ-Knoll 115kV Line				
Bonney Brook 115kV	*184MVAr*	*193MVAr*	*151MVAr*	*160MVAr*
Coolidge 115kV	*443MVAr*	*459MVAr*	*408MVAr*	*423MVAr*
Hayden AZ 115kV	*126MVAr*	*130MVAr*	*75MVAr*	*79MVAr*
N-1 Apache-Butterfield 230kV Line				
Hereford 69kV	*13MVAr*	*13MVAr*	*N/A*	*N/A*
San Rafael 230kV	*21MVAr*	*21MVAr*	*62MVAr*	*62MVAr*
N-1 Apache-Red Tail 230kV Line				
San Simon 69kV	*4MVAr*	*4MVAr*	*N/A*	*N/A*
Red Tail 230kV	*63MVAr*	*63MVAr*	*89MVAr*	*89MVAr*
N-1 Avra-Marana 115kV Line				
Sandario 115kV	*144MVAr*	*144MVAr*	*116MVAr*	*124MVAr*
N-1 Cholla-Saguaro 500kV Line				
Coolidge 115kV	*326MVAr*	*350MVAr*	*411MVAr*	*426MVAr*
N-2 Coronado-Silver King & Cholla-Saguaro 500kV Lines				
Valencia 138kV	*16MVAr*	*19MVAr*	*60MVAr*	*60MVAr*
Vail2 345kV	*25MVAr*	*30MVAr*	*354MVAr*	*357MVAr*
Coolidge 115kV	*96MVAr*	*128MVAr*	*398MVAr*	*413MVAr*

3.4 *Transient Stability Analysis*

To identify the potential voltage impact of the Q24 project, the 2013 peak and off-peak cases with Apache on were monitored for transient stability performance. These cases were chosen as the best modeling of system for the summer peak condition.
None of the outages, applied to pre project cases, created transient stability problems or violation of criteria from WECC W-1 table. Addition of Q24 project does not create any negative impact on transient stability results. The results of transient stability studies can be found in the diagrams, Appendix D.

In order to find out PV plant contribution during a fault, the transient stability study with a fault at Coolidge 115kV bus was conducted. This study confirmed the industry recommended value of **1.1x nominal current** for short circuit contribution of PV plants. The study result plot can be found in the Appendix D, under Coolidge fault results.

3.5 *Short-Circuit Analysis*

In order to perform the short circuit study, the Q24 interconnector was modeled in the Southwest Area Transmission (SWAT) Short-Circuit case using the ASPEN One-Liner software. Three-phase and single-phase to ground faults were simulated at the buses of interest, in the area of study.

The benchmark, or pre-project study was conducted to determine the fault levels at the selected buses. Q24 was added to the post-project cases and the impact on the selected buses was calculated. **Table VI** summarizes the comparison between the fault levels of the pre-project base and post-project cases.

Table VI: Pre-Project Benchmark and Post-Project Comparison at Selected Area Buses

Monitored Bus	Breaker rating (kA)	Pre Project (Sundance & Apache Generation on line)		Post Project w/ Q24 (Sundance & Apache Generation on line)	
		3PH(kA)	SLG(kA)	3PH(kA)	SLG(kA)
COOLIDGE 115kV	40	21.6	24	21.8	24.4
COOLIDGE 230kV	31.5	18.0	16.4	18.1	16.6
HAYDEN 115kV	44	5.4	4.1	5.4	4.1
KNOLL 115kV	63	6.1	4.1	6.1	4.1
Q24 115kV	N/A	0	0	9.8	8.7

Table VI results confirm that the addition of Q24 would not negatively impact ability of circuit breakers to interrupt the short circuit current at selected studied stations.

The complete results of the SC studies can be found in the Appendix E.

4. MITIGATION PROJECTS AND ESTIMATED COST

This section identifies the recommended mitigation measures and their cost. As seen under the thermal results, there are no required mitigation and network upgrades due to the Q24 interconnection.

4.1 Good Faith Estimate of Costs

Following Assumptions were used while establishing the Good faith Estimate of Costs:

1. Customer will provide land of adequate size
2. Customer will provide all required ingress/egress, substation and transmission line easements
3. Customer will provide the rough grading for the substation

The scope of work was estimated for:

1. Substation - 2 bay loop feed station with one 56MVA Transformer
2. Transmission Line – 1 double dead end 115kV pole, 2 tangent transition poles and two line drops.

High-level, good faith/non-binding cost estimate for the Q24 interconnectors is $ 5.5 million, with a targeted accuracy of +/- 40%.

There are some elements of scope that need to be addressed, in particular, a communication path and an auxiliary power source. These will be identified in a facilities study.

5. CONCLUSIONS

The power flow studies proved that the addition of Q24 interconnector would have a negligible impact on surrounding system.

Post Transient, Transient Stability and Short Circuit studies confirmed that Q24 project has no negative impact. There is minor positive impact on system voltages due to the reactive power support that the interconnector provides.

The Harmonics Analysis for Q24 interconnector was not deemed necessary and therefore not performed. However, Q24 has to comply with harmonic current and voltage distortions limits stated in IEEE 519 for 115 kV system. If future PQ monitoring reveal a need for mitigation of harmonic distortions, SRP may require either or both filtering and mitigation applications from Q24 solar plant.

The costs for Q24 were estimated using the assumption of looped feed interconnection. If this assumption changes in future, the estimates for Q24 might diverge from the costs provided here. The specifics of the generator's interconnection to the SRP electric system will be covered in depth as part of Facilities Studies.

The impact of the Q24 were analyzed for the in service year of the project, 2013. No new violations of the WECC system performance criteria were found in the Study's post-project base cases or in the Study's post-project contingency cases.